

Multi level car parking

Jyotirmayee Sethy, Email id: jyotirmayeesethy2017@gmail.com

Student of Civil Engineering Department, Centurion University of Technology and Management, Odisha.

Mr. Smrutiranjana Behera, Email id: smrutiranjana.in@gmail.com

PG in Project Engineering and Management, NICMAR.

Er. Sagarika Panda, Email Id: sagarika.panda@cutm.ac.in

Asst. Prof. of Civil Engineering Department,
Centurion University of Technology and Management, Odisha.

Abstract

The population of the world was increased day by day and also the town and cities increase or developed their public transport. Due to an increase in population car ownership also increased. The car owner used to travel by own vehicles especially. So in a commercial area like the shopping mall, cinema halls, banks, etc, people want to travel by own vehicle each car needs a proper parking space so that the parking demand will be increased as per the demand we should improve the parking facility. For that, we should analyze parking patterns. Nowadays in Bhubaneswar in peak time finding a parking space is a big issue. Unavailable parking people use to park a vehicle on the roadside which caused the fatal accident and major traffic jams. In Bhubaneswar, parking space will be less so it will be a challenge to use that space properly and multilevel car parking is a smart way to park more vehicles in a particular area at a particular time. MLCP comes with several reliefs like optimization of space comfort for drivers to find a space during struggling for parking etc. The research was about present design of a multi-level car park for the alleviation of traffic challenges in public areas using lots of case histories. For this type of parking system, the various designer will design all the part of the structure like arrangements of deck and ramp, planning the dimensions, the bay width, aisle width, ramp dimensions, planning grid, alignment paths to exit barriers, travel distances from the car to the destination, security, visibility, camera, space allowances and lift provision.

Keywords: (Optimization space, urban transport development, traffic objection, Design of the structure, Multi-level car park)

1. Introduction

Now the world goes developed & the pollution increased & in town & cities shopping mall markets were developed. Due to the development of cities people use to travel by own vehicle specially four-wheeler need more space to park. Lots of malls, office & commercial purpose building didn't provide parking facility. So parking is a big issue and to solve that issue multi-level car parking is the way because Multi-level car parking provides more vehicle to be a park in small space with step by step at a particular period sometimes due to on-street parking traffic jam should occur basically in Vani vihar-Saheed Nagar – Janpath and master canteen area in Bhubaneswar have lots of shopping mall market complex station commercial buildings & office are available also most of the people travel on that area by their vehicle and each vehicle need a space for parking and less availability of open space people could not find space to park their vehicle so they will park on the street it will cause a traffic jam to avoid the jam we should provide multi-level parking where we can park more vehicle in a small area with proper security. For that driver cannot get irritated to finding space for parking.

2. Literature review

Zhen (Sean) Qian, Feng (Evan) Xiao, H.M. Zhang (2012): The author will give an idea about how to reduce social cost and traffic congestion with the help of parking fees and parking congestion. Viceroy's morning commute model is extended to incorporate travelers' choices between two parking areas (clusters). The author will explain the parking fees, capacity & its accessibility on destination then

analyze the travel profile of each factor (1)Increasing the central parking facility is not work in every situation. (2)The user should park there vehicle in a particular area should pay an estimated cost as per the time for that parking fees should be set as per time and as per arrival time, the parking capacity should be set. (3) When the access time of a vehicle will be shorter it will reduce the social cost. As per the research they will minimize social cost it the closer parking have not proper accessibility or two large accessibility cluster should be utilized. The problem of delay & social cost solves by optimal parking solutions.[1]

Kumar et al. (2005): This author will explain about GIS-based advanced traveler information which helps to Easily identify the available parking space, entry-exit time record and also help to identify the bus routes, hospital, bus stand hotel, etc which are need for a traveler . also it helps to access the parking on the market area during peak hour. And the driver is easily found a space for parking. The Gis system gives information about all the required facilities available in Hyderabad City because it will be developed and used in Hyderabad city only and now using this technique we can develop our parking facility. [2]

Richard Arnott, John Rowse (2000): the researcher's research about curve side parking also developed the model of curve side parking and traffic congestion in a downtown area. Curve side parking is the cost consuming also reducing the social opportunity cost and also gives a solution about traffic congestion, adjusts to clear the market for curve side **parking spaces. This paper gives a brief idea about traffic congestion,garage parking, and curve side parking.** [3]

Duardo Barata, Luis Cruz, João-Pedro Ferreira(2012): this research will give the data about the significance of integrated parking management policies that explain about the use of parking space and accessibility of parking space also give knowledge about how to collect revenue from parking facility it helps how to use govt unused land as profitably for Govt and it helps to improve the economy. Parking supply and demand flows within the UC campus are estimated.[4]

Paul A. Barter (2013): These papers give a brief idea about international comparative perspective on non-residential, off-street parking policy. parking management should be proper and market-oriented., explain some parking management technique market-oriented parking space proper use of parking technique, etc. [5]

Jin-Mei Ruan1.,(2019) The author will explain about has explained about the traffic management plan, transit plan, and travel demand management initiatives and their codes, guidelines, and programming an event-based transportation management plan, These plans are critically needed to stimulate event attendees to choose public transit as the primary mode especially in a mega-event like Olympic Games.[6]

Ankit Gupta(2019) The researcher will describe the implementation of the concept of a microcontroller-based car parking system who is given the data about sense the presence and movements of cars and as per the space availability and allow for parking and all the procedure displayed on the LCD panel. There is an RFID module that will provide security to the users who have authority can swap the RFID cards and get entry otherwise will not.[7]

Vipul More (2018) this study will explain on Geneva wheel mechanism where the multilevel car parking system for the vendor is working on a simple sprocket chain mechanism. Using a multilevel car parking system can park more vehicles in less space and using this technique can detect the available parking space easily, any issue faced by the user during parking. [8]

G. Narone (2017) have identified predicted or researched the lift mechanism concept that will be implemented. There will explain about two options for lift one is a hydraulic lift and the other is traction lift. For moderate height, a hydraulic lift is suitable but when height increases, it becomes very costly. Traction lift is a cost consuming. The main component of lift is the pallet as per the weight of the vehicle the pallet will be designed using a chain mechanism technique Apply pulling force on the pallet.[9]

3. Need of study

Public transport development or Private car ownership increased so parking showing a big issue in the market as well as in a populated or developed area nowadays. As per the survey, people generally park their vehicle on the roadside or in front of the vehicle and that cause major traffic issue. Because of less availability of parking or improper parking people park 2-3 car in the space of 15-30 car parking space and this project is based on the parking of cars or other vehicles features same as car and this system of parking is allowed to park more vehicle in a small area at particular time period with proper security and cameras it can be accessed by users and operators. Here we have considered a deep scenario of Bhubaneswar city at Vani vihar to Saheed Nagar where lots of market complex shopping malls and Govt and privet offices are present so we found the demand for parking will be more. Therefore, a multilevel car parking system should be required to park more vehicles at a particular period with security. It is aimed at the ideal use of space in Basement Type Parking. It is hydraulically designed. Vertical levels up to 2 levels above ground and one level below ground. We have specially designed to pit puzzle system. This system is used to save space and utilizes the space to park more vehicles in a space of one vehicle.

4. Survey and investigation

Bhubaneswar, the capital city of the State of Odisha is known all over the world as “The City of Temples”. Recently it added another tag to its name as one of the Smartest Cities of India. Bhubaneswar participated in the Smart City competitive two-stage assessment process and has been selected as one of the top Smart cities to be developed in the phase of this initiative. Bhubaneswar topped the list of top 20 cities chosen for first phase implementation. The image of the city is going for a total overhaul. Bhubaneswar Town City District (BTCD) has been identified as implementing the identified Area-based development projects. One of the projects identified is Multi-Level Car Parking (MLCP) at Saheed Nagar. The MLCP is expected to accommodate the commercial parking space requirement of the Saheed Nagar area, which is one of the main CBDs of the city.

4.1. Project Objective:

As part of the Smart City Proposal, the development of multilevel car parking with commercial leasable space will be juxtaposed to semi-automated parking facilities. Multi-Level Car Parking (MLCP) building will give parking space for 255 to 256 nos vehicle as per Equivalent Car Spaces (ECS). All the floors above the parking floors will be used as commercial spaces. Every car parking building will have a lower and upper basement, ground and other above floors of the building was design as per applicable F.A.R as per the Bhubaneswar development authority rules and laws for buildings.

4.2. Site Selection and positioning:

A rapid reconnaissance survey was carried out to identify the best suitable location along with Saheed Nagar and Janpath corridor to house MLCP. The site identified is suitably selected to cater to the parking need of the main commercial followed by institutional and residential areas on the western side of the Janpath road towards NH-5 between Vani Vihar Square and Rajmahal Square. On the eastern end of the Janpath road, there is an institutional area and on the western end, along the road there is a commercial strip and informal commercial around the proposed MLCP site, further surrounded by residential area. The proposed site is suitably located around 700m from the proposed lake neutral project site.

Multilevel parking complexes should be made mandatory requirements in the city center that have several high-rise commercial buildings. The investments in such a parking facility can be made viable through user charges. Commercial complexes with state of the art parking facilities can come up through PPP. This project will help to recover the cost of urban space in the parking of personal vehicles.

4.3. Survey on the market area:



Figure1:Rupali square



Figure2:BMC mall area



Figure3:Vani vihar

4.4. Site surroundings:

The site surrounding is predominantly commercial and institutional.

The left of Janpath houses institutional buildings such as Rama Devi College, IPICOL, IDCO, and Ram Mandir. The right corridor of Janpath is mostly had commercial and retail outlets.

The site is located behind corporation Bank and Syndicate Bank buildings abutting 5 M wide road connecting Nandankanan Zoological Park Head Office.

4.5. Parking space requirement for Different Vehicles

Vehicle	Space Requirement (in sq.m)
Car	20-36
Buses	55 – 60
Trucks	55 – 60
Three Wheelers	10 – 15

Table -2

4.6. Parking Design Layout for Different Types of Vehicles:

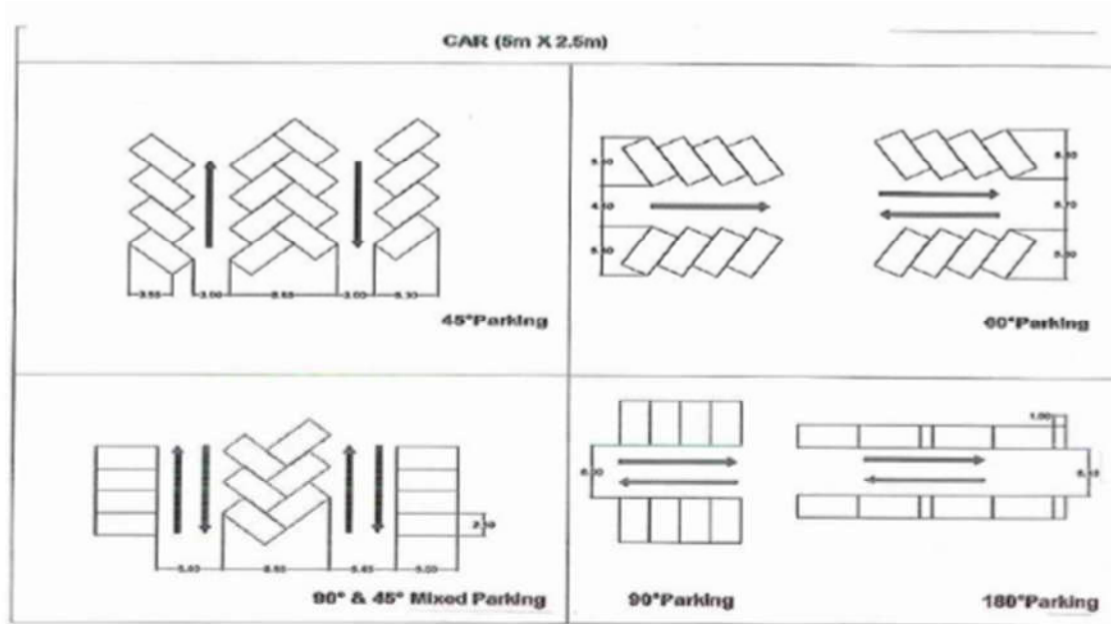


Figure4: Parking layout design for car

4.7. Some of the desired standards for designing of the multi-story car parks:

- The ramp should be designed with gradient 1 in 10 or 1 in 8 for short.
- Floor to floor Clear height should be 2.1m and parking area dimension will be 2.5m X2.5m.
- Curve radius shall be 7m.
- Ramp and entrance width of the building Width is 3.75m.
- The sloping floor gradient should not be steeper than 1 in 20.

Additional width of at least single lane width to be provided in front of MLCP for entry and exit to exit without disturbing the traffic on the main carriageway, however, it is preferable to provide entry and exit ramps at the rear of MLCP or to the road with less traffic. However, each city has its building bylaws to be followed

4.8. Design considerations for MLCP:

As to design, a multilevel car park above ground and below ground has to consider some significance requirements. There should be considering some issues may be faced while people use the project this range from efficient circulation to structural matters, crime prevention, and health & safety aspects. All the details should be discussed below.

4.9. Planning and layout:

While planning for MLCP the first deliberation was the layout of a car park where as the number of vehicle to be accommodated. For underground parking, excavation cost should be considered cost limitations for excavation need to be factored in. Also should take the Vehicle flow rates, which will give the calculations for the number of spaces to be provided to meet demand at peak times in, for example, a shopping center, hostel, and bank.

4.9.1. Multi level car park building slab should be designed as:

- Deck was flat
- Split level

- Sloping deck (or ‘ramped floor’)

4.9.2. Vehicle entrance to parking areas can be:

- Internal ramps
- External ramps
- End or center ramps, or a combination
- Vehicle lifts

4.9.3. Vehicle circulation can be providing by:

- Combined or separate entry/exit
- One-way or two-way traffic

4.9.4. Safety and security:

Safer Parking scheme publication will give safety precaution and accidental issues, Park Mark Safer Parking Scheme gives data about New Build Car Park Guidelines for car park designers, operators, and owners

4.9.5. Design principles:

- S I No. 2174/2002 Act will help on Owners and operators Health & Safety at Work concerning the ‘stability and solidity’ of employment premises.
- Occupiers Liability Act 1957 is enveloped the safety of persons entering the premises legally or else. Boundaries and Perimeters
- Defensible boundaries MLCP must be provide barrier on their perimeter walls and structure
- For high suicide risk location, the Anti-climb measures may also be needed. Example: hospitals.

4.9.6. Lighting:

- Lightplacing must be even, which remove shadows.
- Wall, floors, and ceilings colour should be white (or light-colored) which can lower the number of leading light required.
- Lighting to BS 5489-1:2013 and BS EN 12464-1:2011.
- Anti-vandal cabling guards should be provided
- Lighting columns should arrange in equally spaced or as per the requirement.

4.9.7. Management Practice:

- Entry exit time, no of vehicles details, operators and users details attendants taken or record via phones, AV links, panic alarms.
- Anti-graffiti coatings, easy-clean surfaces measured by Anti-vandalism.
- Use Climbing plants to reduce vandalism.
- Always take care of Safer Parking Scheme.

4.9.8. Decks detail or parking area facilities:

- Proper access control system should provide in underground parking system.
- Provide automatic gates or roller grilles/shutters (certified to LPS 1175 SR2 or WCL 2 BR2), to avoid creating a recess) also give inward opening, but check against means of escape requirements.

- Ramp surface should be rough so it can stop skateboarding.
- Direction arrow should be clear, speed restriction also providing, One-way circulatory traffic also provides.
- The pedestrian route should be specified.
- For motorcycles and bicycles, provide Anchor points.
- In busiest area should not provide payment machines.

4.9.9. Vehicular Access:

- The entry point and exit point must be closer together and separate from each other.
- During parking should provide strict restrictions.

4.9.10. Pedestrian Access:

- Designate vandal-resistant lifts and glazed lobby doors.
- Should not provide long passage.
- Balustrades must be prick or transparent.

4.9.11. Signage:

- Signage should be clearly visible by users & operators, or proper color-coded as per guidelines or codes pictorial, logical, and informative.
- Internationally recognized pictograms are more effective.

4.9.12. Surveillance and CCTV:

- CCTV location should be properly planned (refer to Secured by Design for principles and ideas). Minimize obstructions like columns, for natural surveillance
- Always refer to CCTV Code of Practice, and register with the Information Commissioner, if filming/recording public areas.
- Take all operating details of CCTV from the Data Protection Act 1998.

4.9.13. Landscaping:

- Designate plants, and small trees with low natural growth rates (1m maximum cutback size).
- Plan a maintenance procedure
- In boundaries should provide Spiky bushes, which are more deterrents that are useful.

4.9.14. Operator Requirements:

Always provide Safety for operators while he is on-site, for example in public-facing stands. Some of the standards used for designing of the multi-level car parks:

MLCP to the road with less traffic. However, each city has its building bylaws to be followed.

4.10. Engineering – Structure:

The multi-level car park is building based project which will be constructed as per the building rules and regulation and some open space will be used for the gardening purpose also it was provided underground or basement parking facility. The structure will be made on a frame of reinforced concrete (precast or cast in-situ), steel or some composite structure will be built up with steel whereas beams, column, supporting concrete floor slabs should be used light aggregate, which can reduce the dead load of the building. Also, reinforcement should be provided as a smaller span: depth ratios and additional shear reinforcement.

Concrete must be durable chemical corrosion-free. Moreover, the ramp should be designed to prevent the skidding & Non-slip finished surface.

4.11. Advanced technologies used in multi-level car parking:

- Yellow Pipe Barrier
- Touch Screen Display
- Photo - Electric Sensor
- RE-PARK Logic
- Safety Lock
- Anti - Corrosive Platform

5. Conclusion

A multi-level car parking system is a very good substitute for the car parking area. Looking at the location and development potential of the site, MLCP will be able to accommodate the part of the parking demand of Saheed Nagar particularly, the retail corridor from Pantaloon to the Durga Mandap. Janpath is being redesigned as a Smart corridor with the integration of NMT, cycle highway, pedestrian pathway, and vending street. Janpath has predominantly on street parking which has to lead to the reduction of the effective carriageway from four to three lanes. The re-designing of Janpath is going to restrict the on-street parking to certain areas. This will create a demand for MLCP. In the future, we will add some technology to this Project. We will add more options in the car parking system like priority based parking according to park time. In a multi-level car parking method, the vehicles should be parked floor after floor so it can reduce space for the parking area.

Reference

- [1] Zhen (Sean) Qian a, Feng (Evan) Xiao b, H.M. Zhang c(2012), a Department of Civil and Environmental Engineering, University of California, USA b College of Traffic and Transportation, Southwest Jiaotong University, China c School of Transportation Engineering, Tongji University, Shanghai, PR China.
- [2] Kumar, Bhaskar; Soni, Anshul; Jain, Rahul (2014). An algorithm for detection and recognition of registration number for intelligent car parking system. International Journal of Logistics & Supply Chain Management Perspectives 3.4 (Oct/Dec 2014).
- [3] Richard Arnott a,, John Rowse b “Downtown parking in auto city” a Department of Economics, University of California, Riverside, 4106, Sproul Hall, USA b Department of Economics, University of Calgary, Calgary, AB, Canada T2N 1N4.
- [4] Eduardo Barata , Luis Cruz (Parking at the UC campus: Problems and solutions), João-IPedro FerreiraGEMF and Faculdade de Economia, Universidade de Coimbra, Av. Dias da Silva, 165, 3004-1512 Coimbra, Portugal.
- [5] Paul A. Barter off-istreet parking policy surprises in Asian citizens, LKY School of Public Policy, National University of Singapore, 469C Bukit Timah Road, Singapore 259772, Singapore.
- [6] Szeto WY, Jiang Y, Wang DZW, Sumalee A (2015) A sustainable road network design problem with land use transportation interaction over time. Netw Spat Econ 15(3):791–822
- [7] Ankit Gupta, Ankit Jaiswar, Harsh Agarwal, Chandra Shankar; “Automatic Multilevel Car Parking” International Journal of Electrical and Electronics Research ISSN 2348-16988 (online) Vol. 3, Issue 2, pp: (438-1441), Month: April -1 June 2015.
- [8] Vipul More, Kiran Ravariya, Sohil Shah, Azharuddin Solkar; “AUTOMATIC CAR PARKING SYSTEM USING RFID” International Journal of Engineering Science and Innovative Technology (IJESIT) Volume 4, Issue 2, March 2015.
- [9] Sawankumar G. Narone, Swapnil S. Chabuks, Shriharh A. Valyal, Ravikant B. Hirapure; “Vertical Car Parking – A Prototype” International Journal of Emerging Technology and Advanced Engineering Website: www.ijetae.com (ISSN 2250-12459, ISO 9001:2008 Certified Journal, Volume 5, Issue 4, April 2015)